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Examining the Role of Ethnicity on Healthcare Utilization in Easy Breathing, A Pediatric Asthma Management Program

Vanessa J. Hinckson

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Examining the Role of Ethnicity on Healthcare Utilization in
Easy Breathing©, A Pediatric Asthma Management Program

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B.A., University of Rochester, 2000

A Thesis

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Master of Public Health Thesis

Examining the Role of Ethnicity on Healthcare Utilization in
Easy Breathing®, A Pediatric Asthma Management Program

Presented by

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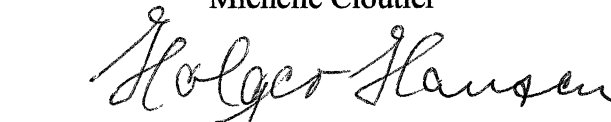
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For The Children

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Chapter I. Introduction

Asthma is a chronic lung disease that has moved to center stage as a public health problem in the past 30 years. Dramatic increases in asthma morbidity and mortality in the 1960s and 1970s, particularly in the British Isles, Australia, New Zealand, and Norway, prompted reviews of asthma deaths in other Western countries.^{1,2} Asthma is now recognized as a common cause of disability, great economic cost, and preventable deaths worldwide. In the United States, the asthma morbidity and mortality rate had historically been low. However, asthma has disproportionately affected African-Americans and Hispanic-Americans in comparison with non-Hispanic white Americans, particularly those living in urban communities.³⁻⁵ The burden of the disease is even more pronounced among minority and inner-city children and Medicaid populations.⁶⁻⁸ Children in lower socioeconomic classes, which include many non-Hispanic children of African origin and Hispanic children of Puerto Rican, Mexican, and other Latino origin, experience an excess of severe asthma, hospitalizations and emergency room (ER) visits for asthma.⁹⁻¹¹ Challenges in outpatient management including underdiagnosis, or poor adherence to national asthma guidelines by patients and primary care physicians, may partially explain the disparity in asthma morbidity observed among urban minority children from low-socioeconomic backgrounds.¹³⁻¹⁷ Although asthma can negatively impact quality of life, lead to costly ER and hospital utilization, and result in potentially life-threatening exacerbations, many of these poor outcomes may be preventable with effective asthma management.

This paper has three specific aims: 1) to study patterns of health care utilization and asthma severity in people of different ethnicities; 2) to determine whether Easy Breathing©, a pediatric asthma management program, is equally effective in treating asthma in Medicaid insured children of different ethnicities who reside in an urban area; 3) to develop a predictive model for health care utilization and cost based on ethnicity, asthma symptoms, residential exposures, and asthma severity. Effective asthma management is defined as a reduction in health care utilization and cost in a 1-year period. This paper summarizes and reviews data from Easy Breathing© for specific endpoints: self-reported asthma prevalence (1997-1998), and health care utilization profiles (1997-1998 and 1999) including outpatient visits, ER visits, hospitalizations, hospital days, and antibiotic medications.

Chapter II. Background

Although there are limited studies that examine asthma severity, those that exist are consistent in their support of a relationship between lower socioeconomic status and more severe asthma throughout childhood and adolescence.^{18,19} A recent study examining the association between childhood asthma and socioeconomic status in industrialized countries found that although an association between childhood asthma and socioeconomic status could not be clearly documented when all levels of severity were combined, strong gradients existed between severe asthma and socioeconomic status.²⁰ The complex relationship between asthma severity and socioeconomic status may be related to adherence to maintenance therapy. Reports have shown that individuals of low socioeconomic status living in urban communities are subjected to underestimations of their asthma severity and inadequate therapy.^{14,15,21} Halterman *et al.* concluded that urban children with persistent asthma were not accurately classified by their providers as having mild persistent to severe persistent asthma and had not been prescribed preventative medications, such as inhaled anti-inflammatory agents.¹⁴

Asthma health care resource use varies between children of different ethnicities. Small-area analyses of asthma hospitalization rates and asthma mortality in New York City, Chicago, and Boston demonstrated that asthma morbidity and mortality were concentrated in inner-city neighborhoods characterized by poverty and large minority populations.^{12,22,23} Gottlieb *et al.* reported that areas with high asthma hospitalization rates had a larger proportion of African-American and Hispanic residents than areas with lower asthma hospitalization rates.¹² This study further reported that areas with high asthma hospitalization rates also had a lower ratio of inhaled anti-

inflammatory medication to inhaled beta-agonists than did areas with low hospitalization rates. The authors concluded that underuse of inhaled anti-inflammatory medication may be one of the many factors that contribute to excess hospitalization among poor urban children.

The causes of excess morbidity and mortality in inner-city neighborhoods are not clear, although possible explanations include a higher level of exposure to agents that cause or exacerbate asthma, and inadequate medical management.^{14,24} Relevant environmental agents include both nonspecific irritants such as air pollution and tobacco smoke, and specific allergens such as dust mite and cockroach antigens. Utilization of health care resources including treatment is affected by access to care, medication costs, and health beliefs. Reports have shown that substandard housing and multiple urban dwellings promote cockroach infestation in American inner-cities.²⁵ Cockroach exposure, for example, is known to represent an important risk factor for acute asthma in predisposed atopic individuals first seen in emergency departments.²⁶ Some authors have also suggested a link between cockroach allergen exposure and the observed increases in asthma associated morbidity and mortality rates among African-American and Hispanic children who live in inner-cities across the United States.²⁷

Additional factors may contribute to the high asthma rates and severity of symptoms among urban, minority children, particularly those who are impoverished. Specific barriers to treatment, differences in the use of medications, access to health care and health education, cultural attitudes, household density, residential exposures, symptoms, and antigen burden may be responsible for the disparities in childhood asthma.²⁷⁻²⁹ One study reported that higher use of emergency department and inpatient

services for asthma among African-American children using Medicaid (compared with white children) could not be fully explained by poverty or inadequate health insurance.⁶⁷ Other studies have documented associations between ethnicity, asthma prevalence, asthma severity, and asthma-related health care resource use.^{6,7,30} Wissow *et al.* found that although African-American children are at increased risk of hospitalization for asthma, most of this increase is related to poverty rather than to race.⁷⁶ Another study reported that African-American children with asthma made 30% fewer physician visits for asthma than non-Hispanic white children with asthma, although differences in income were not controlled.³¹ Further investigations report associations between Medicaid status and the risk for pediatric asthma, hospitalization, emergency department visits, morbidity, and mortality.^{11,32,33} However, a recent study found that lifetime income and sociodemographic characteristics among young African-American children did not explain excess risks of asthma and emergency health care use for asthma.³⁴

Some of these studies typically suggest that reductions in asthma-associated problems could occur through improvements in the health care delivery system and effective asthma management. However, studies investigating the impact of socioeconomic status on asthma are usually limited by their failure to adjust for residential exposures, asthma severity, and health care utilization. Additionally, none of these studies examined the relationship between ethnicity, asthma severity, health care utilization and cost, asthma symptoms, and exposure to household environmental triggers following an asthma management program. These associations must be examined to improve the health and well-being of children with asthma, health care systems, and the quality of asthma management.

Chapter III. Public Health Significance

In the United States, the death rate from asthma has tripled in the past 30 years to more than 5,000 a year.³⁵ Annually, there are an estimated 500,000 asthma-related hospitalizations.³⁵ In 1999, approximately 25 million Americans had been diagnosed with asthma within their lifetime.³⁶ Of these 25 million Americans, approximately 9 million were under the age of 18, and about 4 million of these youth had an asthma episode in the past 12 months. The cost of asthma in 2000 was estimated to be \$12.7 billion, with direct costs amounting to \$8.1 billion and lost earnings due to illness and death totaling \$4.6 billion.³⁶

Asthma is now the most common chronic illness among children and the principal cause of pediatric hospitalization and school absenteeism.⁹ The national rates of asthma deaths, hospitalizations, and emergency department visits have greatly increased, particularly among minority children living in the inner-city.^{4,36,37} In 1997-1999, hospitalization rates were more than three times higher for African-American children than for non-Hispanic white children.³⁵ The prevalence rate of asthma among children in the U.S. is 7%,³⁹ versus reported rates of 10% to 30%^{40,41,77} among children from urban, minority, and low socioeconomic backgrounds.

In the state of Connecticut, asthma prevalence, asthma-related hospitalization and ER rates demonstrate that asthma is strongly associated with socioeconomic factors. In 1998-1999, asthma prevalence rates were slightly higher for African-American children (12%) and Hispanic (13%) children than for white children (9.6%).⁴² In 1992-1998, the average annual hospitalization rate for African-American children was 58/10,000, five times higher than the average annual hospitalization rate for white children, 12/10,000.⁴²

In 1998, hospitalization rates and ER use for children from low-income towns were more than three times higher than those of children from high-income towns. Moreover, while approximately 20% of the State's children 0-14 years of age resided in the five major cities (Bridgeport, Hartford, New Haven, Stamford and Waterbury), children in these cities accounted for 50% of all hospitalizations and ER visits for asthma.⁴²

In Hartford, Connecticut, the prevalence of self-reported asthma in an urban community composed primarily of Latinos of Puerto Rican origin, increased from 20% in 1980 to 33% in 1995 and has further increased to 49% in 1999 (Easy Breathing© data, includes both self-reported and physician confirmed).^{43,44,78} Preliminary data from the Easy Breathing© asthma management program in a study of 6,527 children found an asthma prevalence of 42% in the city of Hartford. Approximately 49% of all Hispanic children (Latino of primarily Puerto origin) and 35% of all African-American children were diagnosed with asthma and assigned a severity.⁴⁴ It was also estimated that 50% of the children with asthma in Hartford have persistent asthma, defined as having asthma symptoms 3 or more days per week or 3 or more nights per month.⁴⁴

Chapter IV. Asthma—Defining the Problem

Pathophysiology

As previously described, asthma is a chronic lung disease that has steadily increased in the United States over several decades.^{36,45} Development of asthma involves the complex interaction of familial, immunologic, infectious, endocrine, allergenic, environmental, socioeconomic and psychologic factors in varying degrees in different individuals.⁴⁶ The exact role of each is not well understood. The disease is characterized physiologically by variable airflow obstruction and pathologically by multiple abnormalities in the airway wall.⁴⁷ The word asthma is derived from the ancient Greek word meaning “panting” or “breathlessness.”⁴⁸ This state of breathlessness occurs when the airways of a person with asthma are stimulated by allergens or other environmental triggers, causing them to experience clinical symptoms of asthma such as cough, wheeze, shortness of breath (dyspnea), sputum production, chest tightness, and evidence of inflammation.⁴⁹ Asthma appears to have two primary responses: the hyperreactive response and the inflammatory response. In the hyperreactive response (also called hyperresponsiveness), the smooth muscles in the airways constrict and narrow excessively in response to inhaled allergens or other irritants, which causes a person with asthma to pant for breath.⁵⁰ Bronchial hyperresponsiveness is followed by the inflammatory response in which the immune system responds to allergens or other environmental triggers by delivering white blood cells and other immune factors to the airways.⁵⁰ These inflammatory factors cause the airways to swell, to fill with liquid, and to produce a thick mucus which clogs the airways and further blocks breathing, resulting

in a generally reversible airway obstruction.⁵⁰ A genetic predisposition combined with environmental factors may explain most cases of childhood asthma. Consensus is building for a theory that proposes that persons with appropriate susceptibility genes for atopy (an inherited familial tendency to have allergic reactions) and asthma, when placed in a specific early life environment, develop a particular type of lymphocytic airway inflammation that results in asthma.⁴⁷

Various allergic and nonspecific stimuli, in the presence of hyperreactive airways, can either induce or trigger the bronchoconstriction and inflammatory response. These stimuli include inhaled allergens (dust mites, pollens, dander, molds, fungi, cockroach, cat, dog, rodent, or bird allergens), cigarette smoke, air pollutants, odors, fumes, cold air, exercise, vegetable proteins, drugs (aspirin, beta-blockers, metabisulfite), viral infection, and even obesity and stress.^{46,51,52} Some patients who develop asthma at a young age have elevated serum IgE levels, suggesting an allergic-extrinsic component in these patients.⁴⁶ Although increased IgE levels may be due to atopy, chronic nonspecific mast cell allergen-induced immune reactions create a prolonged airway hyperreactivity, which can produce bronchospasm in the absence of identifiable extrinsic factors.⁴⁶ Research has demonstrated associations between increased outdoor and indoor allergens (e.g., airborne ozone, sulfur dioxide, dust mite, cat, cockroach) and increased incidence of asthma.^{24,26,72} Some scientists theorize that children who spend more time in the house, watching television, playing video games, or using the computer have more opportunity to become exposed to carpets and furniture that may be full of asthma-triggering dust mites, cockroach antigens, and/or animal dander.⁵³ A related theory is that people are

spending more of their time in modern, energy-efficient and less drafty houses, which are so air-tight that triggers such as animal dander, dust and chemicals never get a chance to escape.⁵⁴ Another theory is that children's immune systems are compromised by the reduction in early childhood infections—because they are appreciably protected from disease early on in life, they might be more susceptible to asthma later on.⁵⁵ It is interesting to note, however, that some studies have reported that exposure to common allergens, such as house-dust endotoxin, house-dust mite, and cats in the first year of life may actually *prevent* later development of allergies and asthma.^{56,57} One study reported on the effects of endotoxin, a byproduct of common bacteria from soil and animal and human feces that finds its way into household air and dust.⁵⁶ In this study, infants who lived in homes with high levels of endotoxin generally did *not* develop allergies to dust mites, cats, dogs, cockroaches, mice, milk, egg, and soy, whereas children in homes with low endotoxin levels were significantly more likely to develop such allergic sensitivities. The authors find that chronic indoor endotoxin exposure may protect against allergen sensitization in young asthma-prone children by enhancement of type 1 immunity. Another study investigated the relation between cat and mite allergen exposure and the development of asthma in a large cohort of German children up to age 7 years. Assessments included repeated measurement of specific IgE to food and inhalant allergens, measurement of indoor allergen exposure at 6 months, 18 months, and 3 years of age, yearly interviews by a pediatrician, and measurements of pulmonary function and bronchial hyperresponsiveness at age 7 years. Although exposure to indoor allergens was related to sensitization, there was no relation between early indoor allergen exposure and the prevalence of asthma, wheeze, and bronchial hyperresponsiveness. The authors

conclude that the induction of specific IgE responses and the development of childhood asthma may be determined by factors independent of allergen exposure, such as genetic and other environmental factors.⁵⁷ Nevertheless, these studies reported that for children or adults with existing allergies or asthma, exposure to endotoxin or common allergens worsened the condition. Other experts observe that poor air quality, inadequate use of asthma therapy, psychosocial problems, and inadequate access to good medical care have contributed to increased morbidity and mortality.^{13,28,58}

Although there is no cure for asthma, effective outpatient management is available. Many exacerbations leading to hospitalizations and ER visits are preventable, so much so that the frequency of hospitalizations and ER visits for asthma has become a common outcome measure and proxy for quality of primary care. Recent advances in medicine have improved the understanding of asthma and the ability to manage it effectively. Managing asthma may require a comprehensive approach that includes consistent and culturally appropriate medical treatment; patient compliance with drug regimens; the provision of detailed provider, patient and family education; the development of a strong patient-doctor relationship; and the reduction of risk factors that may exacerbate asthma.^{42, 65,73}

Diagnosis, Treatment, and Management

In 1997, the National Asthma Education and Prevention Program (NAEPP) issued revised guidelines for the diagnosis and management of asthma.⁵⁹ The report described the appropriate use of available therapies in the management of asthma. Recommendations for the treatment of asthma were organized around four key components: 1) Use of objective measures of lung function to assess the severity of

asthma and to monitor the course of therapy; 2) Environmental control measures to avoid or eliminate factors that precipitate asthma symptoms or exacerbations; 3) Comprehensive pharmacologic therapy for long-term management designed to reverse and prevent the airway inflammation characteristic of asthma as well as pharmacologic therapy to manage asthma exacerbations; and 4) Patient education that fosters a partnership among the patient, his or her family, and clinicians.⁵⁹ The report noted that patient education, in particular, is the cornerstone of asthma management and should be delivered by health care professionals providing asthma care. The report recommended that education begin at the time of asthma diagnosis and be integrated into every step of asthma care. It also suggested that asthma self-management be tailored to the needs of each patient, maintaining a sensitivity to cultural beliefs and practices. Further recommendations included the need for health care providers to systematically teach and frequently review with patients how to manage and control their asthma. The report found that patients should be provided with and taught to use a written daily self-management plan and an action plan for asthma exacerbations.

According to the guidelines, asthma should be identified and diagnosed based on a combination of a history of characteristic symptoms and objective evidence of airway hyperresponsiveness with variable obstruction.^{59,60} The guidelines also recommended that asthma severity be classified according to the new classification scheme. The new scheme distinguishes between mild intermittent asthma and 3 categories of persistent asthma: mild, moderate, and severe. Treatment is based on severity classification (Figure 1). As noted in the guidelines, classification can be accomplished by performing pulmonary function tests or by assessing the frequency of asthma symptoms. Pulmonary

function tests, such as spirometry, are used to confirm the diagnosis and determine the severity of the disease.⁶¹ Spirometry can demonstrate both the presence of airflow obstruction and the reversal of this obstruction spontaneously or as a result of medication.⁶¹ Using a spirometer (an instrument that measures the air taken into and exhaled from the lungs) the physician determines several values: vital capacity (VC), the maximum volume of air that can be inhaled or exhaled; peak expiratory flow rate (PEFR), the maximum flow rate that can be generated during a forced exhalation; and forced expiratory volume (FEV1), the maximum volume of air expired in one second.⁶¹ In cases of airway obstruction, these measurements may fall. The doctor then may administer a bronchodilator to open the air passages and repeat the measurements. If the obstruction clears after using the drug, then a diagnosis of asthma is confirmed.⁴⁶ The patient may also be given skin or blood allergy tests, particularly if a specific allergen is suspected.⁴⁷

Home monitoring of the PEFR is recommended initially to categorize the severity of asthma, to help educate the patients to recognize changes in asthma severity, and to monitor the response to changes in asthma therapy.⁶¹ Primary care provider and patient assessment of symptoms, signs, and expiratory flow rates are essential to care and treatment. Consequently, patient education takes on heightened importance because of the need for constant monitoring and adherence to treatment. However, time pressures and staffing limitations in primary care practices may limit the teaching effort and contribute to inadequate asthma outcomes.⁶² When neither the patient nor the provider can accurately assess or treat the severity of asthma, delays in diagnosis and treatment

occur that may be a cause of increased number of hospitalizations and emergency department visits, and of asthma-related morbidity and mortality.⁶³

The NAEPP guidelines recommend that primary care providers supply patients with written self-management plans based on symptoms and PEFs to guide treatment of acute asthma. However, a recent study found inadequate adherence to the guidelines by primary care providers for the management of pediatric asthma.⁶⁴ Only 50% of the primary care physicians enrolled in the self-reported study provided written asthma care plans to their patients. The study also found that primary care physicians' criteria for referral to an asthma specialist differed from those of the national expert panel in choosing to manage more severe patients without asthma specialist input. Further inadequacies in provider knowledge and the use of anti-inflammatory therapy were also found. Another study that examined provider compliance with the NAEPP guidelines concluded that attempts to improve adherence to asthma guidelines should take into consideration provider underestimation of asthma severity.¹⁴ Another study surveyed family physicians in Connecticut to examine their adherence with the NAEPP guidelines of asthma education and management.¹⁷ The study found that family physicians do not adequately comply with the guidelines, and that the mean number of positive responses was significantly lower for physicians who identified language barriers, large proportions of African-American and Hispanic-Americans, and large proportions of non-English speaking patients. It has also been documented that written asthma management plans presented as part of the national guidelines are not well-understood or followed among poor inner-city populations in which there is both low literacy and high prevalence and

severity of asthma.^{15,16} These studies demonstrate the importance of the development of better strategies to improve the management of asthma.

Disease management strategies can be used to customize teaching interventions (for both providers and patients), provide information technology to identify patients, monitor care, and control costs.⁶⁰ Primary care physicians, for example, can learn ways to customize for individual patients those elements that pertain to patient self-monitoring and self-treatment of an exacerbation.⁶⁰ Treatment of an exacerbation might need to be made more individualized rather than based on peak flow, and the patient instructed to contact the physician if symptoms do not resolve within a certain period of time.^{60,65} Asthma management programs designed to improve provider knowledge and use of the guidelines may be crucial to improve the diagnosis and treatment of asthma.

Easy Breathing© Program

Easy Breathing© is an asthma management program for children in Hartford, Connecticut. The program is specifically designed to improve the diagnosis and treatment of asthma by busy primary care providers; to improve the health status of children with asthma; and to reduce medical care expenditures. The program is based upon the NHLBI:NAEPP asthma guidelines. It utilizes a validated survey, a standardized treatment menu based upon asthma severity and NHLBI guidelines and a standardized treatment plan. A survey is given to all children (aged 6 months to 18 years) who present for care for any reason at any of the 6 primary care clinics in Hartford, Connecticut (Figure 2). These clinics, serve >88% of the Medicaid-eligible children in the city. Children are diagnosed with asthma based upon their responses to the survey questions, a review of the medical record and additional history and testing as deemed appropriate by

the provider. For each child with asthma, a comprehensive Asthma Treatment Plan consisting of a daily, sick, and emergency treatment plan is developed using a treatment selection guide and special labels developed by the program and given to the provider. The family is given a written treatment plan specifically designed for the population being served and patient/parent education is provided using program developed materials.⁶⁶ The patient population consists of primarily Hispanic/Puerto Rican children and African-American children who live in urban settings. Providers receive approximately sixty to ninety minutes of training specifically about Easy Breathing© and about how to use the forms as part of a comprehensive asthma management program. The program also includes weekly clinic visits by one of the pulmonary physicians, an inpatient asthma nurse educator, and home visits by MCO-funded health reach workers and Visiting Nurses.

Prior to the implementation of Easy Breathing©, 8.8% of Hartford's children with asthma were prescribed inhaled corticosteroids and 9% of the children were prescribed non-steroidal anti-inflammatory drugs. A preliminary review of Easy Breathing© treatment plans, demonstrated that 39% of all children with asthma were prescribed inhaled corticosteroid therapy, while 11% of all children were prescribed inhaled non-steroidal anti-inflammatory therapy. Approximately 50% of children in Hartford have persistent asthma. Since the implementation of Easy Breathing©, this has translated to 94% adherence to guidelines for primary care providers. These rates have remained stable throughout the first 22 months of the program's operation. Therefore, Easy Breathing© is the first large study to demonstrate a sustained change in provider prescribing behavior. Easy Breathing© is currently being replicated, with improved

treatment plans, in other communities and settings such as in urban/suburban, insured, private practices (Easy Breathing© II).

Chapter V. Research Design

Conceptual Model

As previously described, asthma is a significant health problem among children in the United States. Urban, minority, and low-socioeconomic groups are at disproportionately higher risk for hospitalizations, ER, acute care visits, and death from asthma in comparison with non-Hispanic whites.⁹⁻¹² These groups are also less likely to receive and use inhaled anti-inflammatory medication for asthma.^{13,14} The difference in risk, in particular, may exist because minority groups are more likely to live in urban areas. Poverty, lack of access to health care, cultural and language barriers, personal health beliefs, and/or genetic predisposition to asthma or to greater asthma severity may also play a role.^{12,22,23,28,47} Risk factors for asthma morbidity at the micro-environmental level may vary by ethnic group because of different cultural views about the illness, its origins, treatment and management. Other risk factors may include indoor environmental measures, such as level of pet dander, dust mite antigen, cockroach allergen, passive exposure to tobacco smoke or other indoor aeroallergens and irritants.²⁴⁻²⁷ Taken together, these factors may be linked with ethnicity and might serve to increase their risk for asthma or correlate with health care service use. The literature, and qualitative and quantitative data from the Easy Breathing© program provide the basis for several testable propositions that guide this project, resulting in the conceptual model diagrammed in Figure 3.

As the conceptual model indicates, this paper proposes that health care utilization (i.e., the use and cost of particular health care services) among children with asthma is related to, and driven by, the degree of asthma severity. In addition, both health care

utilization and asthma severity are influenced by the presence of asthma symptoms, residential exposures, and a child's ethnic background. Given the relationships among these variables, effective interventions to prevent, reduce, treat, and manage pediatric asthma are those that target the interactions among health care utilization, asthma severity, asthma symptoms, residential exposures, and ethnicity.

The conceptual model leads to the following testable hypotheses:

1. Patterns of health care utilization among Medicaid Hispanic children will be the same than Medicaid African-American children. Specific patterns of health care utilization to be examined include: hospitalizations, ER visits, outpatient visits, and antibiotic medications.
2. Patterns of disease among Medicaid Hispanic children will be the same as Medicaid African-American children. Specific patterns of disease to be examined include: asthma severity, residential exposures, and asthma symptoms.
3. Health care utilization among Medicaid Hispanic and African-American children will be reduced equally after implementation of the Easy Breathing© Program.
4. Ethnicity, asthma symptoms, residential exposures, and asthma severity will predict health care utilization.

Definitions and Indicators

Health Care Utilization refers to the use and cost of the following health care services provided by the Department of Social Services: the number of ER visits, hospitalizations, outpatient visits, steroid and antibiotic medication.

Asthma Severity refers to a relatively stable characteristic of the individual that reflects the pathophysiology of the disease which may change over time. This is

classified as Mild, Intermittent; Mild, Persistent; Moderate Persistent; Severe, Persistent based upon their symptoms within the past 12 months.

Ethnicity refers to the background, or affiliation resulting from racial or cultural ties, and is divided into two groups: African-American, which includes children of Caribbean/Virgin Island origin, and Hispanic-American, which includes children of Puerto Rican/Mexican and other Latino origin.

Residential Exposures refer to factors within the home that may contribute to the development and exacerbation of asthma, including exposure to cigarette/cigar smoke, cockroaches, dust, pets, and/or rodents.

Asthma Symptoms refer to a child experiencing any of the following symptoms at anytime during the preceding 12 months of their initial parent-reported responses: wheezing or whistling in the chest; nighttime awakening cough; coughing, wheezing, or shortness of breath with exercise or activity; cough with colds that lasts for more than 10 days.

Chapter VI. Materials and Methods

Collection of Data

Two primary data sources were utilized: 1) the Easy Breathing© Survey, and 2) the Department of Social Services (DSS) claims data. The Easy Breathing© Survey was specifically designed to assist primary care providers in making a diagnosis of asthma in children (Figure 2). The survey has been validated, and is used as part of the Easy Breathing© asthma management program. The survey provides cross-sectional, parent-reported data on demographic information, residential exposures, symptomatology, history of asthma, and asthma severity for children 6 months to 18 years of age. Children are diagnosed with asthma based upon their responses to the survey questions, review of the medical record and additional history and testing deemed appropriate by the provider. Asthma diagnoses are made according to recommended National Heart, Lung, and Blood Institute: National Asthma Expert Panel Guidelines.⁷⁵ Four questions on the survey were shown to be sensitive and specific for determining the presence of asthma. A positive response to any 1 of the 4 questions was over 94% sensitive for asthma, while a negative response to all 4 questions was 55% specific for excluding asthma.

The DSS claims database was used for secondary analysis of health care utilization by children receiving care at the 6 primary care sites in Hartford, Connecticut. Children surveyed between 6/1/98-12/31/98 were included in the analysis. This enabled each child to have had an opportunity for some utilization, yet also permitted transience in health plan membership, as often occurs with Medicaid insurance. The DSS provided data on fixed reimbursements for health care services. The costs are set at \$1750 for an inpatient day (room & board), \$40 for an outpatient visit, and \$113 for an ER visit. This

data allowed for pre- and post-Easy Breathing comparison of health service delivery costs per ethnic group (Table 9).

Between 1997 and 1998, claims data were available for 764 children. All 764 children appear in 1999 data. In 1999, claims data became available for 91 other children enrolled in the program during the study period. This resulted in a convenience sample of 855 children for analysis of health care utilization.

Selection of Study Population

All children with previously diagnosed asthma, newly diagnosed asthma, or with an initial asthma diagnosis that was either “unable to determine” or “no” initially but was later diagnosed as asthma were considered in the analyses. Analyses focused on urban, Medicaid-eligible, Hispanic and African-American children with mild to severe asthma. Participants were 17 years of age or less, calculated at date of first enrollment.

Variables

Independent measures were constructed using responses to the validated survey. Independent variables included ethnicity, age, gender, asthma severity (Mild, Intermittent; Mild, Persistent; Moderate, Persistent; Severe, Persistent), asthma symptoms (wheezing/whistling in the chest; nighttime awakening cough; coughing, wheezing, or shortness of breath with exercise; a cough with colds that lasts for more than 10 days), and residential exposures (cigarette/cigar smoke from mother or other household member, pets {dog, cat, bird, rodent, other}, cockroaches, dust, and rodents). Dependent measures were constructed using claims data matched to those children diagnosed with asthma. Dependent variables included outpatient visits, ER visits, hospitalizations,

hospital days, and number of antibiotic medications collapsed into dichotomous categories of zero and *any* (1 or more).

Chapter VII. Statistical Analysis

This analysis was based on data from two time periods: 7/97 – 6/98 (pre-Easy Breathing) and for 1999 (post-Easy Breathing). Preliminary and secondary data analyses utilized SPSS software.

Preliminary data analysis

Descriptive statistics were used to examine representativeness among African-American (n = 281) and Hispanic children (n = 877) for all variables, followed by a series of chi-square analyses to examine differences between each group. Cross-tabulation analyses were used to determine the relationships among ethnicity, wheeze symptoms, residential exposures, and asthma severity, and the cost of health care services.

Secondary data analysis

Distribution of utilization events within each of the five different types of services were markedly skewed for both study periods, with a substantial proportion of nonusers for ER visits, hospitalizations, hospital days, and number of antibiotic medications. This distribution pattern necessitated using logarithmic transformations, but no improvements in data estimates were possible. A two-step analytic approach was performed to compare health care utilization between African-American children (61%, 172 out of 281) and Hispanic children (69%, 605 out of 877). The first step was to compare the two ethnic groups with respect to proportion of children who used a given type of service at least once. This step involved a binary outcome variable: “never-used service” versus “ever-used service.” Initial statistical testing used the chi-square test. For later analyses, binary logistic regression models were developed to estimate which variables had independent

associations with health care utilization during pre- and post-Easy Breathing periods. The regression models included *only* predictor variables which were statistically significant in preliminary analyses. The following predictor variables were entered in a single block method: wheezing/whistling in the chest, exposure to smoke from mom and others, rodents, pet dogs, asthma severity, ethnicity, age, and gender. Other regression models were stratified by African-American and Hispanic to determine which factors predicted health care use among each ethnic group. Asthma severity was entered into the model categorically as Mild, Intermittent; Mild, Persistent; Moderate, Persistent; and Severe, Persistent. This first step yielded an odds ratio (OR) and 95% confidence interval for each type of service, reflecting the extent to which each factor predicted the percentage of children who used that service. The second step was to compare the utilization rates (continuous variables) between children in each ethnic group. For example, the number of outpatient visits among African-American children who ever utilized outpatient services was compared with that of Hispanic children who ever utilized outpatient services. Nonparametric two-related samples tests were performed to compare means and determine pre- and post-Easy Breathing patterns of health care utilization. Nonparametric tests assume that the two distributions have the same shape, although this shape does not have to be normal.

Chapter VIII. Findings & Discussion

Description of Findings

Characteristics of Sample

There were 1298 children enrolled in the Easy Breathing© program between 6/1/98 and 12/31/98 of which 1158 were minority (89%). A description of the children included in the study analysis is provided in Table 1. Of the 1158 children, 281 (24%) children were reported by their parents to be of African-American ethnicity and 877 (76%) were Hispanic primarily of Puerto Rican origin. The racial/ethnic distribution was consistent throughout the study. The 281 African-American children and 877 Hispanic children were similar with respect to age and gender characteristics.

Preliminary Statistics

Asthma Severity, Symptoms, and Residential Exposures

African-American children and Hispanic children differed with respect to asthma severity, and exposures. Tables 2, 3, 7 and 8, describe the differences in distribution of asthma severity, type of asthma symptoms, and exposures for each ethnic group, using the chi-square test in cross-tabulation analyses.

As Table 2 illustrates, asthma severity differed by ethnicity with African-American children having more Mild, Intermittent asthma compared to Hispanic children (55.2% vs 46.4%). Hispanic children had more Moderate, Persistent and Severe, Persistent asthma compared to African-American children (19.2% and 2.7% vs 11.0% and 2.1%, respectively). These results were statistically significant ($P < 0.01$). Table 3 illustrates that parent-reported residential exposures differed among African-American children compared to Hispanic children. African-American children with asthma had a

higher percentage of parent-reported exposure to cigar/cigarette smoke from mother and others ($P < 0.01$), and dust ($P < 0.05$) compared to Hispanic children. Hispanic children with asthma had a higher percentage of parent-reported exposure to cockroaches, pet dogs and birds compared to African-American children ($P < 0.01$). Exposure to dust was associated with increasing asthma severity regardless of ethnicity ($P < 0.01$, Table 3a).

Health Care Utilization

Health care utilization data were available for a total of 855 children. Of these 855 children, 172 (20%) reported they were of African-American ethnicity and 605 (71%) reported they were of Hispanic ethnicity.

Patterns of Health Care Utilization, Pre-Easy Breathing Period

Patterns of health care utilization varied by asthma severity during the pre-Easy Breathing period (Table 4). Bonferroni tests for trend analysis indicated that outpatient visits, ER visits, hospitalizations, and hospital days were significantly different with increasing asthma severity ($P < 0.05$). Children with Mild, Persistent asthma utilized fewer hospital days and than children with Severe, Persistent asthma ($P < 0.05$). Children with Mild, Persistent asthma also utilized more antibiotic medication than children with Mild, Intermittent, Moderate, Persistent, or Severe, Persistent asthma, however, these results were not significant at $\alpha = 0.05$.

Patterns of health care utilization also differed by ethnicity during the pre-Easy Breathing period (Tables 5 and 6). Table 5 shows the proportion of children in each ethnic group who used services at least once during each of the two study periods. Hispanic children had more outpatient visits and ER visits (88% and 50%, respectively) compared to African-American children (69% and 34%, respectively) ($P < 0.001$).

As Table 6 illustrates, African-American children had lower rates of outpatient visits and ER visits than Hispanic children during the pre-Easy Breathing period ($P < 0.01$).

Patterns of Health Care Utilization, Post-Easy Breathing Period

Patterns of health care utilization for all levels of asthma severity decreased during the post-Easy Breathing period (Table 4). When comparing ethnicities (Table 5), there was a higher percentage of outpatient visits among Hispanic children compared to African-American children (86% vs 73%) during this period ($P < 0.001$). As Table 6 illustrates, health care utilization among both groups of children decreased during the post-Easy Breathing period. African-American children had significantly lower rates of outpatient visits than Hispanic children ($P < 0.001$). When compared to the pre- Easy Breathing period, African-American children had lower rates of ER visits ($P < 0.01$), and hospitalizations ($P < 0.05$), while Hispanic children had significantly lower rates of outpatient visits, ER visits, hospital days, and antibiotic medication. African-American children did have a large decrease in hospital days and antibiotic medication during the post-Easy Breathing period, however, these results were not significant at $\alpha = 0.05$.

Asthma Severity

When controlling for asthma severity, there were no significant differences between ethnicities and exposure to dust or the presence of asthma symptoms (Table 7). There were also no significant differences between ethnicities when stratifying by asthma symptoms, gender, and age (Table 8). The results of health care utilization data during the pre- and post-Easy Breathing periods remained statistically significant after controlling for asthma severity.

Regression

Two sets of binary regression models (not shown) examined the five types of health care utilization. Inclusion of individual variables into the models was based upon whether a significant difference was found between the two groups of children after controlling for asthma severity. Both sets of models included the following predictor variables: wheezing/whistling in the chest, exposure to smoke from mom and others, rodents, and pet dog, asthma severity, ethnicity, age, and gender. However, the first set of models included ethnicity as a predictor to determine whether ethnicity was a useful parameter to the model and whether subsequent models could be stratified by ethnicity to compare utilization between African-American and Hispanic children. Logistic analysis for ER visits and number, antibiotics, and asthma severity during pre- and post-Easy Breathing periods are illustrated in Table 10. Boxplots are included to compare the distribution of health care utilization among one ethnic group versus the other, and among each asthma severity (Figures 4 and 5). Since the scales for each variable differed markedly, the variables were transformed to standard values using *z scores* before plotting the values.

Pre-Easy Breathing Period

Table 9 shows the results of binary regression. During the pre-Easy Breathing period, Hispanic children aged 0-4 years were 4 times more likely to have 1 or more ER visits than African-American children (OR, 4.6; 95% CI, 2.6, 8.1, $P < 0.001$), and 5 times more likely to receive 1 or more antibiotics than African-American children (OR, 5.9; 95% CI, 3.0, 12.1, $P < 0.001$; Figure 4). Similarly, Hispanic children aged 5-9 years were 3 times more likely to receive 1 or more antibiotics than African-American children

(OR, 3.1; 95% CI, 1.5, 6.3, $P < 0.01$; Figure 5). No statistical differences in utilization existed between the two ethnic groups and wheezing/whistling in the chest, exposure to smoke from mom and others, rodents, pet dogs, and gender (data not shown). African-American children with Mild, Intermittent asthma and Hispanic children with Mild, Intermittent and Mild, Persistent asthma showed a tendency for 1 or more hospitalizations and hospital days during the pre-Easy Breathing period (OR, 0.032; 95% CI, 0.002, 0.486, $P < 0.05$; vs OR; 0.085, 95% CI, 0.016, 0.445, $P < 0.01$ and OR; 0.115, 95% CI, 0.022, 0.607, $P < 0.05$). However, the low ORs may reflect a small sample of children with Mild, Intermittent and Mild, Persistent asthma admitted to the hospital, particularly for an asthma exacerbation. It is possible that a larger sample would yield less dramatic OR results. Similarly the sample size of children with asthma of higher severity may have been too low to produce observable differences in regression analyses.

Post-Easy Breathing Period

Table 9 shows the results of binary regression. During the post-Easy Breathing period, Hispanic children aged 0-4 years were 4 times more likely to receive 1 or more ER visits than African-American children (OR, 4.2; 95% CI, 2.3, 7.6, $P < 0.001$). Hispanic children aged 0-4 years and 5-9 years were 2 times more likely to receive 1 or more antibiotics than African-American children (OR, 1.9; 95% CI, 1.0, 3.7, $P < 0.05$ and OR, 2.2; 95% CI, 1.2, 4.1, $P < 0.01$). No significant differences in utilization existed between the two ethnic groups and all other predictor variables (data not shown).

Health Expenditures

The expenditure of health care service decreased for all children after implementation of the Easy Breathing© program (Table 10). The differences were

statistically significant for outpatient visits, ER visits, and hospital days at $\alpha = 0.01$. When comparing health care expenditures by ethnicity for pre- and post-Easy Breathing periods, African-American children had significantly lower ER visits and hospital days; and Hispanic children had significantly lower outpatient visits, ER visits, and hospital days. Health care services resulted in an average of \$1473.85 (pre-Easy Breathing) and \$798.98 (post-Easy Breathing) paid by Medicaid per person-year (Table 11). Hispanic children incurred 1.35 times the cost of total asthma-related payments per capita than African-American children during the pre-Easy Breathing period (\$1674.96 vs \$1241.05), and 2.20 times the cost of total asthma-related payments per capita than African-American children during the post-Easy Breathing (\$940.94 vs \$429.13). The unadjusted cost was not computed for number of hospitalizations and antibiotic medication because the figures were not provided for analysis. Program costs were also not figured into analysis.

Discussion

Parent-reported data

Residential exposures, as reported by parents, varied between the study groups. African-American children with asthma were exposed to more cigarette or cigar smoke from mother and others, and dust compared to Hispanic children. In contrast, Hispanic children were exposed to more cockroaches, rodents, and pet dogs at home compared to African-American children. Exposure to dust correlated with increasing asthma severity regardless of ethnicity. These indoor environmental exposures may have contributed to asthma exacerbations and high utilization of services among both groups of children. African-American children presented with more Mild, Intermittent asthma compared to

Hispanic children. Conversely, Hispanic children had more Moderate, Persistent and Severe, Persistent asthma compared to African-American children.

Health Care Utilization

More health care services were utilized among African-American and Hispanic children prior to the implementation of the Easy Breathing© program. During the pre-Easy Breathing period, Hispanic children had more outpatient visits, ER visits, and antibiotic medication compared to African-American children. The use of more health care services was demonstrated for children with increasing asthma severity. A reduction in health care services was demonstrated among African-American and Hispanic children and among each level of disease severity regardless of ethnicity after the implementation of the Easy Breathing program. During the post-Easy Breathing period, African-American children had lower rates of ER visits, and hospitalizations, hospital days, and antibiotic medication, while Hispanic children had lower rates of outpatient visits, ER visits, hospital days, and antibiotic medication. These results suggest that a more targeted approach to treating asthma in outpatient management among African-American children and inpatient services (i.e., hospitalizations and hospital days) among Hispanic children may be necessary.

The results of regression analyses indicate that wheeze symptoms, residential exposures, asthma severity, and age were good predictors of health care utilization. Patterns of health care utilization differed between the two study groups before and after enrollment into the Easy Breathing© program, when controlling for ethnicity, asthma severity, symptoms, age, gender, and insurance status. As evidenced by pre- and post-

Easy Breathing (adjusted) data, Hispanic children aged 0-4 years and aged 5-9 years were more likely to have 1 or more ER visits and receive 1 or more antibiotic medications than African-American children. The frequent ER visits and antibiotic use observed in this study reflect the high levels of asthma morbidity reported in Medicaid claims. The results suggest that a higher prevalence of ER visits correlates with more intensive prophylactic therapy. The results further demonstrate that even with apparent access to an asthma care provider, there is a greater burden of asthma among many Hispanic families.

Health Care Expenditures

The total expenditure of health care among children in this study was \$1473.85 before the implementation of Easy Breathing© and \$798.98 after the implementation of Easy Breathing©. These figures are not comparable with other studies because of the high charge for an inpatient day.^{10,67,68} The distribution of cost for care was higher among Hispanic children compared to African-American children during the pre-Easy Breathing period (\$1674.96 vs \$1241.05) and post-Easy Breathing (\$940.94 vs \$429.13). These results may be due to a higher distribution of asthma severity among Hispanic children. Nevertheless, the overall reduction in health care expenditure coupled with mostly lower rates of utilization among both African-American and Hispanic children after enrollment into the Easy Breathing© program suggests that the intervention was effective in treating asthma.

Limitations

Several limitations of this study should be noted. First, this study involved self-reported data by parents for asthma symptoms and residential exposures. Recall bias of symptoms and inaccurate reporting of exposures may have affected some of the data included for analyses. Second, the groups were collapsed from individual ethnic identifiers for the purpose of simplifying statistical analyses. The dichotomous definition of each ethnicity obscures the complexity of their meaning. Parents either reported that their child was an African-American or Caribbean/Virgin Islander, or Hispanic/Mexican, Hispanic/Puerto Rican, or Hispanic/Other, but that was not necessarily always the case. Some parents may have reported that they identified their child as belonging to two or more ethnic groups, such as being both African-American and Hispanic/Puerto Rican, or Caribbean/Virgin Islander, White/Caucasian and Hispanic/Other. In such instances, the ethnicity was entered as “Other” into the Easy Breathing© database. This particular classification may have affected the subject selection and characteristics of the sample and contributed to a lower sample size. In addition, whether actual differences in health care utilization are due to differences in ethnicity, asthma symptoms, asthma severity, and residential exposures, or to other factors not considered (such as type and age of housing; regional distribution of homes such as being close to a highway; indoor carpeting; number of pets, other type of pets in the household not listed on the survey; and the extent of genetic influences on asthma) is not clear. It is also possible that variation in provider communication and style, continuity, hours of availability, length of waiting time and cultural awareness could account for some of the observed differences in utilization and disease patterns. Likewise, the patient’s or family’s cultural health

beliefs and attitudes toward health care providers may have conflicted with the self-management of the child's asthma. A third important limitation of this study resulted from claims information provided to analyze health care utilization. The claims information was not specific to asthma-related utilization. Therefore, it is not known what types of confounding health conditions existed which could contribute to high utilization.

Advantages

This study differs from previously reported analyses on minority children with asthma in two ways. First, it examined the role of asthma severity, asthma symptoms, residential exposures, gender, age, and ethnicity on health care utilization in an urban population. Second, it examined the role of a pediatric asthma management program to assess and treat asthma in Medicaid children of two different ethnicities. The children's eligibility for Medicaid allowed for the control of socioeconomic information such as level of income and insurance status. The fact that utilization differences exist within a Medicaid population suggest that these differences are not solely due to differences in health care insurance.

Recommendations

In this study, asthma severity was influenced by residential exposures. Concomitantly, health care utilization appears to be influenced by asthma severity and the child's age. These findings suggest that health care utilization for children with asthma could be prevented or reduced by eliminating exposures to indoor allergens in housing such as dust. The results demonstrated that young Hispanic children with

persistent asthma are higher users of health care services than African-American children. Therefore, health care providers need to develop improved methods of diagnosis and treatment to reduce utilization among this group of children, such as better approaches to patient centered education and home management.

This study only reviewed quantitative data. Future studies of urban, minority, and low socioeconomic children with asthma should review both quantitative and qualitative approaches. For example, qualitatively identifying potential barriers to optimal asthma care for urban, minority, and low socioeconomic children with asthma as conveyed by patient's, their families and/or providers may be the first step to reducing the burden of the disease in this population, as well as others.²⁸ Interviews, focus groups, and free-listing/pile sorting are useful methodologies to collect qualitative data and to uncover barriers and cultural differences.^{69,70} In this study, asthma severity and ethnicity were found to be useful predictors for health care utilization, which is comparable to findings in other studies.^{34,67} Ethnicity can be an important marker for other characteristics that determine utilization. These characteristics might include family and cultural health belief systems, cultural attitudes toward healthcare providers, and differences in patient and provider communication. It is important for future researchers to discern which institutional, cultural/behavioral, and societal characteristics mediate the influence of African-American and Hispanic ethnicities on the use health care services. To improve provider- and self-management of asthma, asthma management programs targeting children such as those studied in this paper, could develop targeted/culturally sensitive surveys that address the difficulties in access to quality care. A cultural assessment framework (CAF) can be used to help disease management programs develop such

surveys and aid in intervention planning (Figure 6).^{70,71} A CAF can help to accurately determine target population specifics, such as health needs, perceptions and concerns; what makes group members unique as a cultural or ethnic group, such as their cultural values and beliefs; and what special planning efforts will be needed to deliver culturally appropriate services to them.⁷⁰ Asthma care providers and researchers also need to be aware of the differences in personal/cultural health care beliefs among African-American and Hispanic patients. Individualized interventions could be developed to improve asthma management (e.g., patient-provider communication, asthma education, self-monitoring, and action plans) among these two ethnic groups. Such an intervention should be based on a health belief model which incorporates principles of self-efficacy, readiness-to-learn, and change.^{70,72}

Another effective way to enhance healthy behaviors and self-efficacy is through the use of modeling. The principle of modeling underlies the development of self-help groups.⁷⁰ Modeling among a study population can be achieved in the context of supportive small-groups, mutual aid, the use of lay instructors, and the use of culturally- and age-appropriate models in educational materials such as videos and pamphlets. Easy Breathing© utilizes several of these approaches. For example, the population of patients enrolled is provided health care access through Medicaid, and Spanish-speaking patients are provided with culturally appropriate treatment surveys, plans, and booklets. Patient and families are also persuaded to make small, incremental behavior changes through practice and observing someone else (e.g., their physician, nurse, health educator) modeling the desired behavior of using asthma rescue devices. However, neither videos of the model asthma management practice and procedures nor supportive small-groups

are yet available through Easy Breathing©. Providing the patient/family with a model asthma management video would be helpful because they could watch and practice it at their own leisure and not solely at the health care setting. In addition, focus groups could help to identify patient and family perspectives of barriers to asthma care in urban, minority populations. Focus groups would allow the researchers and program developers to obtain a more in-depth understanding of barriers that affect patient and parent care practices and a better appreciation of the underlying health beliefs that act as barriers to optimal health outcomes.²⁸

The Easy Breathing© program is beginning to examine some of these cultural concerns. The program is currently researching the cultural, social and psychological factors responsible for the high ER usage by Puerto Rican families. This study will compare Puerto Rican families to African-American families and to Caucasian families.

Conclusion

In summary, this study provides important information about health care utilization and asthma severity between children of different ethnicities. Replicating this study in other similar communities would further enhance our understanding of the impact of ethnicity on health care utilization and cost for children with asthma, and inform the improvement of asthma management. This study also demonstrates that the Easy Breathing© program is effective in reducing utilization and expenditure of asthma-related health care services among Medicaid-insured African-American and Hispanic children. The program appears to be more effective among African-American children, which suggests that asthma management providers and planners may need to develop

more individualized and culturally appropriate asthma education materials for Hispanic families.

REFERENCES

1. Stolley PD: Why the United States was spared an epidemic of death due to asthma. *Am Rev Respir Dis*. 1972;105:883-890.
2. Pearce N, Beasley R, Crane J, *et al*. End of the New Zealand asthma mortality epidemic. *Lancet*. 1995;345:41-44.
3. Weiss KB, Wagener DK. Changing patterns of asthma mortality: Identifying target populations at high risk. *JAMA*. 1990;264:1683-1687.
4. The National Heart, Lung, and Blood Institute Working Group. Respiratory diseases disproportionately affecting minorities. *Chest*. 1995;108:1380-1392.
5. Homa DM, Mannino DM, Lara M. Asthma Mortality in U.S. Hispanics of Mexican, Puerto Rican, and Cuban Heritage, 1990-1995. *Am J Respir Crit Care Med*. 2000;161(2):504-509.
6. Beckett WS, Belanger K, Gent JF, *et al*. Asthma among Puerto Rican Hispanics: A multi-ethnic comparison study of risk factors. *Am J Respir Crit Care Med*. 1996;154:894-899.
7. Crain EF, Weiss KB, Bijur PE, *et al*. An estimate of the prevalence of asthma and wheezing among inner-city children. *Pediatrics*. 1994;94:356-362.
8. Davidson AE, Klein DE, Settipane GA, Alario AJ. Access to care among children visiting the emergency room with acute exacerbations of asthma. *Ann Allergy*. 1994;72(5):469-73.
9. Weitzman M, Gortmaker S, Sobol A, Perrin JM. Recent trends in the prevalence and severity of childhood asthma. *JAMA*. 1992;268:2673-2677.
10. Lozano P, Sullivan SD, Smith DH, Weiss KB. The economic burden of asthma in US children: Estimates from the National Medical Expenditure Survey. *J Allergy Clin Immunol*. 1999;104(5):957-963.
11. Rand CS, Butz AM, Kolodner K, *et al*. Emergency department visits by urban African-American children with asthma. *J Allergy Clin Immunol*. 2000;106(1):83-90.
12. Gottlieb DJ, Beiser AS, O'Connor GT. Poverty, race, and medication use are correlates of asthma hospitalization rates. *Chest*. 1995;108:28-35.
13. Halterman JS, Aligne A, Auinger P, *et al*. Health and healthcare for high-risk children and adolescents: Inadequate therapy for asthma among children in the United States. *Pediatrics*. 2000;105(1):272-76.

14. Halterman JS, Yoos HL, Kaczorowski JM, McConnochie K, *et al.* Providers underestimate symptom severity among urban children with asthma. *Arch Pediatr Adolesc Med.* 2002;156(2):141-146.
15. Warman KL, Silver EJ, Stein RE. Asthma symptoms, morbidity, and anti-inflammatory use in inner-city children. *Pediatrics.* 2001;108(2):277-82.
16. Forbis SG, Aligne CA. Poor readability of written asthma management plans found in national guidelines. *Pediatrics.* 2002;109(4):e52.
17. Jusseaume S, Lewis J. Connecticut family physician adherence to NAEP Guidelines for management of asthma (unpublished manuscript).
18. Persky VW, Slezak J, Contreras A, Becker L, *et al.* Relationships of race and socioeconomic status with prevalence, severity, and symptoms of asthma in Chicago school children. *Ann Allergy Asthma Immunol.* 1998;81(3):266-71.
19. Newacheck PW, Halfon N. Prevalence, impact, and trends in childhood disability due to asthma. *Arch Pediatr Adolesc Med.* 2000;154(3):287-293.
20. Mielck A, Reitmeir P, Wjst M. Severity of childhood asthma by socioeconomic status. *Int J Epidemiol.* 1996;25:388-393.
21. Crain E, Kercsmar C, Weiss K, Mitchell H, Lynn H. Reported difficulties in access to quality care for children with asthma in the inner city. *Arch Pediatr Adolesc Med.* 1998;152:333-339.
22. Carr W, Zeitel L, Weiss K. Variations in asthma hospitalizations and deaths in New York City. *Am J Public Health.* 1992;82:59-65.
23. Marder D, Targonski P, Orris P, *et al.* Effect of racial and socioeconomic factors on asthma mortality in Chicago. *Chest.* 1992;101:426S-429S.
24. Lanphear BP, Kahn RS, Berger O, *et al.* Contribution of residential exposures to asthma in US children and adolescents. *Pediatrics.* 2001;107(6):E98.
25. Sarpong SB, Hamilton RG, Eggleston PA, Adkinson NF. Socioeconomic status and race as risk factors for cockroach allergen exposure and sensitization in children with asthma.
26. Gelber LE, Seltzer LH, Bouzoukis JK, *et al.* Sensitization and exposure to indoor allergens as risk factors for asthma among patients presenting to a hospital. *Am Rev Respir Dis.* 1993;147:573-78.
27. Call RS, Smith TF, Morris E, *et al.* Risk factors for asthma in inner city children. *Pediatrics.* 1992;1221:862-866.

28. Mansour ME, Lanphear BP, Dewitt TG. Barriers to asthma care in urban children: parent perspectives. *Pediatrics*. 2000;106(3):512-519.
29. Aday LA, Lee ES, Spears B, Chung CW, *et al*. Health insurance and utilization of medical care for children with special health care needs. *Med Care*. 1993;31:1013-1026.
30. Litonjua AA, Carey VJ, Weiss ST, Gold DR. Race, socioeconomic factors, and area of residence are associated with asthma prevalence. *Pediatr Pulmonol*. 1999;28(6):394-401.
31. Taylor WR, Newacheck PW. Impact of childhood asthma on health. *Pediatrics*. 1992;90:657-662.
32. Weitzman M, Gortmaker S, Sobol A. Racial, social, and environmental risks for childhood asthma. *Am J Dis Child*. 1990;144:1189-1194.
33. Emerman CL, Cydulka RK, Rimm A. Changes in asthma claims in a Medicaid population from 1991-1994. *Am J Emerg Med*. 1999;17:526-531.
34. Miller JE. The effects of race/ethnicity and income on early childhood asthma prevalence and health care use. *Am J Public Health*. 2000;90(3):428-430.
35. National Heart, Lung, and Blood Institute News Release. NHLBI reports new asthma day for world asthma day 2001: Asthma still a problem but more groups fighting it. *Retrieved from the World Wide Web* November 9, 2001: <http://www.nih.gov/news/pr/may2001>.
36. Trends in asthma morbidity and mortality. American Lung Association Epidemiology and Statistics Unit Best Practices and Program Services. February, 2002.
37. Mannino DM, Homa DM, Pertowski CA, *et al*. Surveillance for Asthma – United States, 1960-1995. *MMWR*. 1998;47(SS-1):1-28.
38. National Institute of Allergy and Infectious Diseases News Release. NIAD Inner-City Asthma Study Finds Multiple Factors Lead to Increased Asthma Morbidity. *Retrieved from the World Wide Web* November 9, 2001: <http://www.niaid.nih.gov/newsroom/releases>.
39. Gergen PJ, Mullally DI, Evans R III. National survey of prevalence of asthma among children in the United States, 1976 to 1980. *Pediatrics*. 1988;81:1-7.
40. Newacheck PW. Poverty and childhood chronic illness. *Arch Pediatr Adolesc Med*. 1994;148:1143-1149.

41. Halfon N, Newacheck PW. Childhood asthma and poverty: differential impacts and utilization of health services. *Pediatrics*. 1993;91:56-61.
42. Fleisner ML, Adams M, Kertanis JC. Connecticut Department of Public Health, Bureau of Community Health. Epidemiology of Asthma in Connecticut, May 2001.
43. Pachter LM, Cloutier MM, Bernstein BA. Ethnomedical (Folk) remedies for childhood asthma in a mainland Puerto Rican community. *Arch of Pediatr Adol Med*. 1995;149:982-988.
44. Cloutier MM, Hall CB, Rowe T, Bailit H, *et al*. Easy Breathing©, an asthma management program for inner city children. Abstract *Am Rev Resp Crit Care Med*. 2000.
45. Evans R, Mullaly DI, Wilson RW, *et al*. National trends in morbidity and mortality of asthma in the US: Prevalence, hospitalization and death from asthma over two decades: 1965-1984. *Chest*. 1999;91(suppl):65-78.
46. Behrman RE, Kliegman RM, Jenson HB. Nelson Textbook of Pediatrics 16th ed. Philadelphia, W. B. Saunders Co., 2000.
47. Murray JF, Nadel JA. Textbook of Respiratory Medicine 3rd ed. Philadelphia, W. B. Saunders Co., 2000.
48. Webster M. The New Webster's Dictionary of the English Language International ed. New York, Lexicon Publications, Inc., 1990.
49. Sears MR. Descriptive epidemiology of asthma. *Lancet*. 1997;350(suppl II):14.
50. Cotran RS, Kumar V, Collins T. Robbins Pathologic Basis of Disease 6th ed. Philadelphia, W. B. Saunders Co., 1999.
51. Gennuso J, Epstein LH, Paluch RA, Cerny F. The relationship between asthma and obesity in urban minority children and adolescents. *Arch Pediatr Adolesc Med*. 1998;152(12):1197-200.
52. Okelo S. Krishman JA, Skinner EA, *et al*. The role of emotional health in the outcomes of adolescents with asthma (abstract). *Am J Respir Crit Care Med*. 2002;165(8):A664.
53. Carter MC, Perzanoski MS, Raymond A, Platts-Mills TA. Home intervention in the treatment of asthma among inner-city children. *J Allergy Clin Immunol*. 2001;108(5):732-37.
54. Williams-Hayden ML. Environmental control and the management of allergic diseases. *Immunol. and Allergy Clin of North Am*. 1999;19(1):83-99.

55. Farooqi IS, Hopkin JM. Early childhood infection and atopic disorder. *Thorax*. 1998;53(11):927-32.
56. Gereda JE, Leung DYM, Thatayatikom A, Streib JE, *et al*. Relation between house-dust endotoxin exposure, type 1 T-cell development, and allergen sensitisation in infants at high risk of asthma. *Lancet*. 2000;355:1680-83.
57. Lau S, Illi S, Sommerfeld C, Niggemann B, Bergmann R, *et al*. Early exposure to house-dust mite and cat allergens and development of childhood asthma: a cohort study. *Lancet*. 2000;356:1392-97.
58. Wright RJ, Steinbach SF. Violence: an unrecognized environmental exposure that may contribute to greater asthma morbidity in high risk inner-city populations. *Environ Health Perspect*. 2001;109(10):1085-9.
59. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health: *Guidelines for the diagnosis and management of asthma*, Publ No 91-3042, Aug 1991.
60. Goroll AH, Mulley AG. Primary Care Medicine 4th ed. Philadelphia, Lippincott Williams & Wilkins: A Wolters Kluwer Co., 2000.
61. Middleton E, Ellis EF, Yunginger JW, *et al*. Middleton: Allergy: Principles and Practice 5th ed. New York, Mosby-Year Book, Inc., 1998.
62. Page A. Improving pediatric asthma outcomes using self-management skills. *Nurse Pract*. 2000;25(11):16-33.
63. Kolbe J, Vamos M, James F, *et al*. Assessment of practical knowledge of self-management of acute asthma. *Chest*. 1996;109:86-90.
64. Finkelstein JA, Lozano P, Shulruff R, *et al*. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics*. 2000;106(4 Suppl):886-96.
65. Bonner S, Zimmerman BJ, Evans D, *et al*. An individualized intervention to improve asthma management among urban Latino and African-American Families. *J Asthma*. 2002;39(2):167-79.
66. Marder DM, Cloutier MM. Asthma education: are inner-city families getting the message? *J Respir Dis*. 1999;20:630-5.
67. Lozano P, Connell FA, Koepsell TD. Use of Health Services by African-American children with Asthma on Medicaid. *JAMA*. 1995;276(6):469-473.

68. Smith DH, Malone DC, Lawson KA, *et al.* A national estimate of the economic costs of asthma. *Am J Respir Crit Care Med.* 1997;156:787-793.
69. Schensul SL, Schensul JJ, LeCompte MD. Essential Ethnographic Methods 2nd ed. Altamira Press, A Division of Sage Publications, Inc., California, 1999.
70. Huff RM, Kline MV. Promoting Health in Multicultural Populations. Sage Publications, Inc., California, 1999.
71. Hinckson V. Application of a Cultural Assessment Framework to the Easy Breathing©, a Pediatric Asthma Management Program (unpublished).
72. Rosenstock I.M, Stretcher VJ, Becker MH. Social Learning theory and the health belief model. *Health Educat Quart.* 1988;15:175-183.
73. Koenig JQ. Air pollution and asthma. *J Allergy Clin Immunol.* 1999;104(4 Pt 1):717-722.
74. Thoonen BP, Schermer TR, Jansen M, *et al.* Asthma education tailored to individual patient needs can optimise partnerships in asthma self-management. *Patient Educ Couns.* 2002;47(4):355-60.
75. Hall CB, Wakefield D, Rowe TM, Carlisle PS, Cloutier MM. Diagnosing pediatric asthma: validating the Easy Breathing© Survey. *J Pediatr.* 2001;139(2):267-72.
76. Wissow LS, Gittelsohn AM, Szklo M, *et al.* Poverty, race, and hospitalization for childhood asthma. *Am J Public Health.* 1988;78(7):777-82.
77. Christiansen SC, Martin SB, Schleicher NC, *et al.* Current prevalence of asthma-related symptoms in San Diego's predominantly Hispanic inner-city children. *J Asthma.* 1996;33:17-26.
78. Guarnaccia P. Asthma in a low-income community: the correlates of illness severity and health system utilization. Storrs: University of Connecticut 1984. Microfilm 8418819 retrievable from University of Michigan, Ann Arbor.

APPENDIX

Figure 1. National Asthma Education and Prevention Program Classification of Asthma Severity

Clinical Features Before Treatment*			
Classification	Symptoms**	Nighttime Symptoms	Lung Function
Mild intermittent	<ul style="list-style-type: none"> ❖ Symptoms occur twice a week or less. ❖ No symptoms and normal lung function between attacks. ❖ Attacks are brief (from a few hours to a few days) and may vary in intensity. 	Twice a month or less.	<ul style="list-style-type: none"> ❖ FEV₁ or PEF is 80% or more than predicted. ❖ PEF variability is less than 20%.
Mild Persistent	<ul style="list-style-type: none"> ❖ Symptoms occur more than twice a week but less than once a day. ❖ Asthma attacks may be severe enough to affect activity. 	More than twice a month.	<ul style="list-style-type: none"> ❖ FEV₁ or PEF is 80% or more than predicted, ❖ PEF variability is between 20% and 30%.
Moderate Persistent	<ul style="list-style-type: none"> ❖ Daily symptoms and use of inhaled short-acting beta₂-agonists. ❖ Symptoms twice a week or more and may last for days. ❖ Asthma attacks twice a week or more and may be severe enough to affect activity. 	More than once a week.	<ul style="list-style-type: none"> ❖ FEV₁ or PEF is between 60% and 80% of predicted, ❖ PEF variability is more than 30%.
Severe Persistent	<ul style="list-style-type: none"> ❖ Continual symptoms. ❖ Limited physical activity. ❖ Frequent asthma attacks. 	Frequent.	<ul style="list-style-type: none"> ❖ FEV₁ or PEF is 60% or less than predicted, ❖ PEF variability is more than 30%.

Figure 1. Continued

* The presence of one of the features of severity is sufficient to place a patient in that category. An individual should be assigned to the most severe grade in which any feature occurs. The characteristics noted in this figure are general and may overlap because asthma is highly variable. It should be noted that many life-threatening situations have started in patients categorized with mild asthma. An individual's classification may also change over time.

** Patients at any level of severity can have mild, moderate, or severe asthma attacks. Some patients with intermittent asthma experience severe and life-threatening exacerbations separated by long periods of normal lung function and no symptoms.

Adapted from National Asthma Education and Prevention Program (National Heart, Lung, and Blood Institute) Second Expert Panel on the Management of Asthma. Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma. Bethesda, MD: National Institutes of Health, 1997; publication no. 97-4051.

Figure 2. Easy Breathing© Survey

Reviewed By: _____ Attending: _____

Child's Name: _____

Date : _____

**EASY BREATHING SURVEY**

Please answer all of the questions about your child. If you are unsure of an answer, ask your doctor for help.

1. Has your child had wheezing or whistling in the chest at any time in the last 12 months? Yes No
2. Has your child awakened at night because of coughing in the last 12 months? Yes No
3. Has your child had coughing, wheezing or shortness of breath with exercise or activity and had to stop because of these symptoms at any time in the last 12 months? Yes No
4. Does your child bring up phlegm from the chest first thing in the morning? Yes No
5. What symptoms does your child usually have when he/she has a cold? (circle all that apply)
 - a) wheezing
 - b) coughing
 - c) shortness of breath
 - d) chest pain or chest tightness
 - e) tiredness
 - f) other _____
6. When your child has a cold, does the cough usually last more than 10 days? Yes No
7. What makes your child cough, wheeze or become short of breath? (circle all that apply)
 - a) colds
 - b) changes in weather
 - c) changes in season
 - d) exposure to dust, cats, dogs, other animals
 - e) exposure to tobacco smoke

- f) exercise
- g) emotions (cry, laugh, anger)
- h) other _____
- i) my child doesn't cough, wheeze or become short of breath

8. Does your child have any allergies?

Yes No

If yes, to what is your child allergic? _____

9. Has anyone told you your child has asthma?

Yes No

If yes, who? _____

10. Is your child currently taking any medicines, pills or inhalers (pumps, puffers) for asthma? Yes No

11. Does anyone in your family have asthma?

Yes No

If yes, who _____

12. Has anyone told you your child has eczema?

Yes No

13. What is your child's ethnic origin (Circle one):

African-American Asian or Pacific Islander Caribbean/Virgin Islander
Hispanic/Mexican
Hispanic/Puerto Rican Hispanic/Other White/Caucasian
Other

14. What is your child's date of birth _____

15. How tall is your child? _____ How much does your child weigh?

16. What is your child's sex? Male Female

17. What street do you live on? _____

18. What is the number of the building you live in? _____

19. How long have you lived at this address? _____

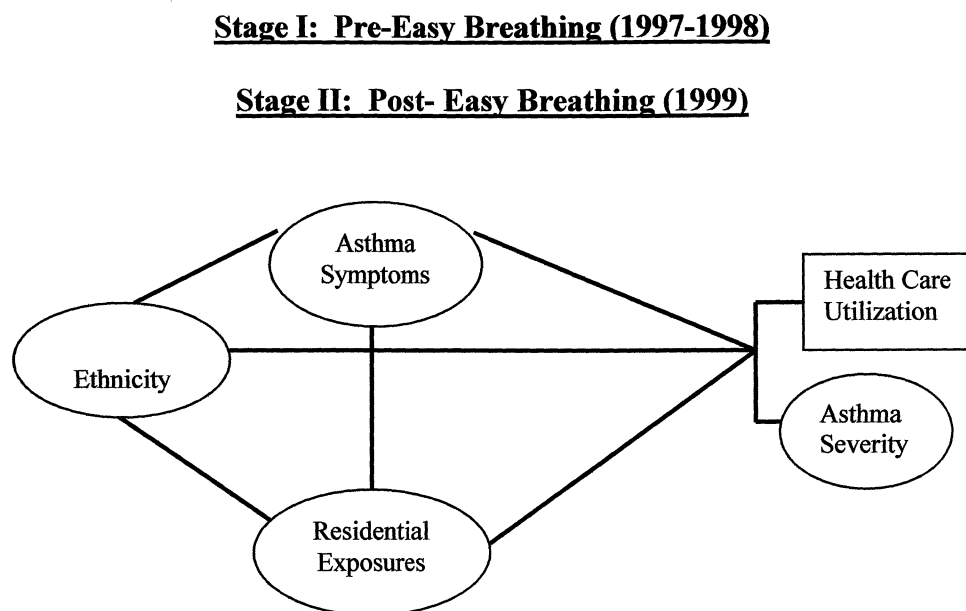
20. What type of building do you live in? (Circle one)

Single family Multifamily (Circle number of units): 2 3 4 5 more than 6

21. How many people live in your home? Adults: _____
Children: _____
22. Does your child go to school? Yes No School Name: _____
Does your child go to daycare? Yes No What type? (circle one) In
home Commercial
23. Is your child exposed to the following more than 2 times/week:
- Cigarette or Cigar smoke Yes No
If yes, who smokes (mother, father, grandparents, etc.)? _____
- Fireplace or Wood-burning Stove Yes No
Cockroaches Yes No Dust Yes No
Rodents (mice or rats) Yes No Gas Stove Yes No
Chemical solvents or paints Yes No Perfume or Potpourri Yes No
Pets Yes No
Type of pet: (Circle all): Dog Cat Bird Rodent Other
24. Is your child exposed to pets at school? Yes No
Type of pet: (Circle all): Dog Cat Bird Rodent Other
25. Could you tell us something about your child's bedroom? (Circle all that apply)
- Floor Covering: Bare floor Wall to wall carpet Area rug
Linoleum
Window Treatment: None Fabric curtains Blinds
Shades
Type of Heat: Gas Forced hot air Electric Baseboard
Oil Don't know

**Thank you for your help. PLEASE GIVE THIS SURVEY TO YOUR
DOCTOR IN CLINIC TODAY.**

Figure 3. Conceptual Model



Conceptual research model showing hypothesized relationships among independent and dependent variable domains during Stage I and II of the Easy Breathing© intervention.

Figure 4. Boxplot of Standardized Health Care Utilization by Ethnicity

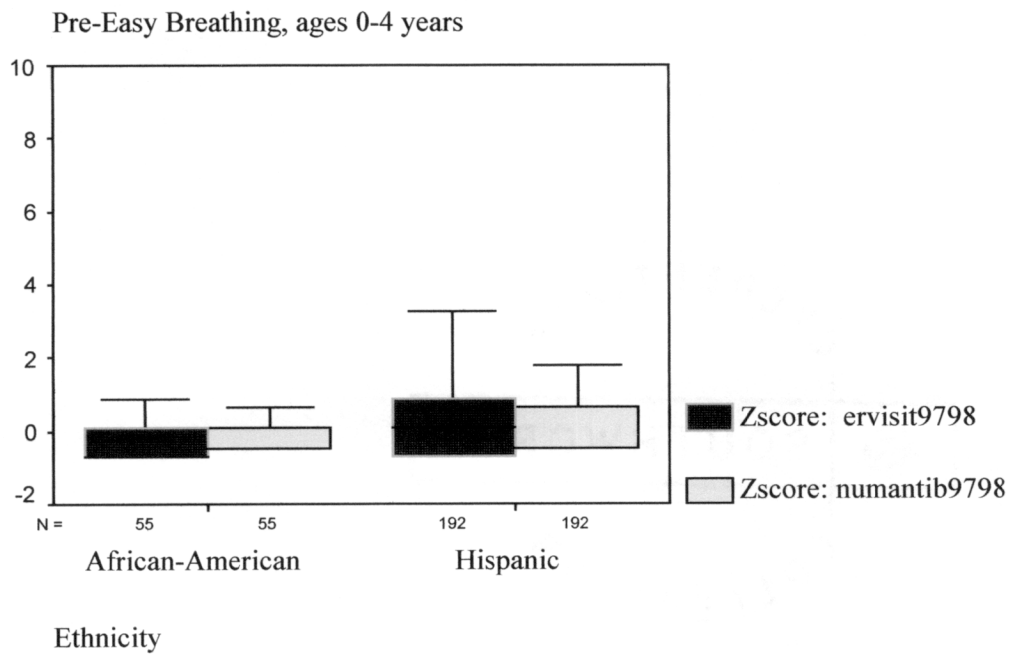


Figure 5. Boxplot of Standardized Number of Antibiotics by Ethnicity

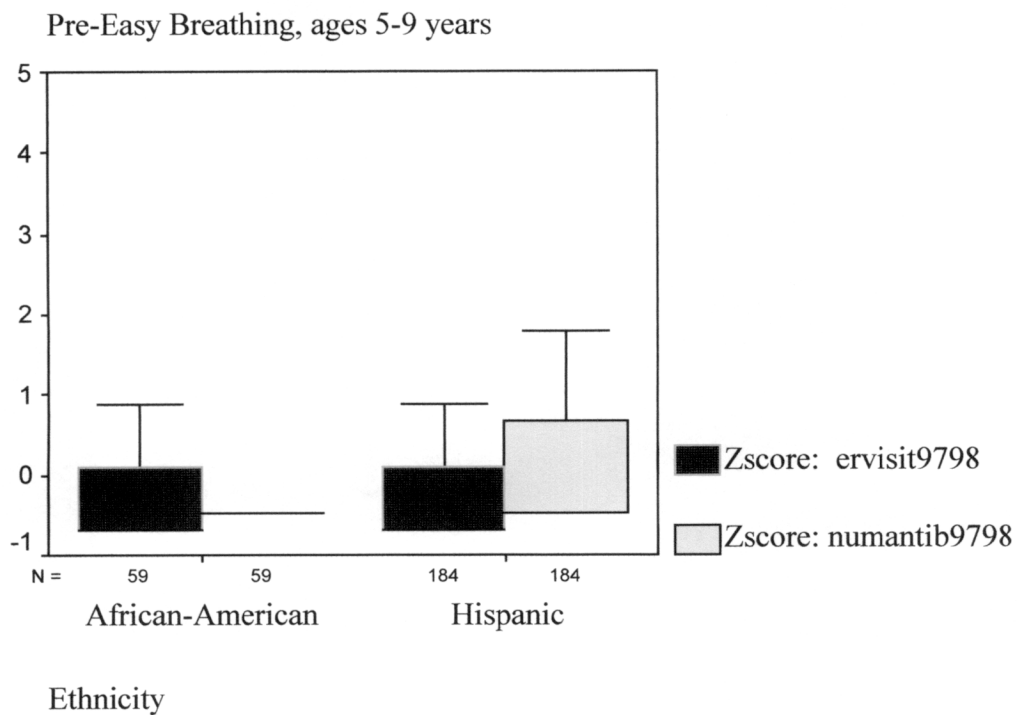


Figure 6. Parental Assessment Survey

Confidential. Do not sign your name.

For each question, please circle the number for the answer which best reflects your opinion. If you are unsure of an answer, please ask us for help.

Medication and Treatment

1. Have you ever used traditional therapies to treat and prevent your child's asthma?

1. yes
2. no

If yes, what kind?

1. breathing exercises
2. calming techniques
3. visualization techniques
4. herbal remedies
5. teas
6. special foods
7. vapor rubs
8. Other (please specify):

If yes, how often?

1. always
2. frequently
3. rarely

2. Are you against medications and do not allow your child to consume them?

1. yes
2. no

3. Are you comfortable giving medications to your child with the special medication devices (such as the nebulizer)?

1. yes
2. no

4. Do you prefer or usually seek care for your child in the emergency department?

1. yes
2. no

Healthcare Providers

1. Do you consult with traditional healers or listen to other nonmedical individuals to help manage your child's asthma?

1. always
2. frequently
3. rarely
4. never

2. Are you satisfied with the care your child's school nurse provides?

1. very satisfied
2. somewhat satisfied
3. somewhat dissatisfied
4. very dissatisfied
5. don't know

3. **Are you comfortable with nonnurse school personnel, such as teachers, giving medications and/or supervising the care of your child's asthma?**
 1. very comfortable
 2. somewhat comfortable
 3. somewhat uncomfortable
 4. very uncomfortable
 3. don't know
4. **Have you received counseling from your child's doctor about the effects of physical activities or exercise on your child?**
 1. yes
 2. no
5. **Would you like your child's doctor to provide more information about the effects of physical activities or exercise on your child?**
 1. yes
 2. no

Home Environment

1. **Please circle which of the following you own or use in your home:**
 1. vacuum cleaner
 2. air conditioner
 3. air purifier
 4. air humidifier
 5. none
2. **If you own/use a vacuum in your home, how often do you change the vacuum bag?**
 1. once per month
 2. every other month
 3. once per year
 4. never
 5. don't know
3. **If you own/use an air conditioner in your home, how often do you change the air filter?**
 1. once per month
 2. every other month
 3. once per year
 4. never
 5. don't know
4. **If you own/use an air purifier in your home, how often do you change the air filter?**
 1. once per month
 2. every other month
 3. once per year
 4. never
 5. don't know

5. **If you own/use an air humidifier in your home, how often do you change the air filter?**
1. once per month
 2. every other month
 3. once per year
 4. never
 5. don't know
6. **Are you unable to modify your home environment because you rent or live in a home with individuals who smoke or have pets?**
1. yes
 2. no

Cost and Insurance

1. **Are you unable to make changes to your home environment (such as purchasing a vacuum, a room air conditioner, an air purifier, or replacing carpet) because of the cost?**
1. yes
 2. no
2. **How often are you unable to purchase asthma medications for your child because of the cost?**
1. often
 2. sometimes
 3. rarely
 4. never
3. **Do you feel that your insurance status and type of insurance affects the type of health services provided to care for your child's asthma?**
1. yes
 2. no
4. **Are there any HMO restrictions regarding ED access that you feel inhibits care for your child's asthma?**
1. yes
 2. no
 3. don't know
5. **Are there any HMO restrictions on the type of equipment (like nebulizers and aerochambers) that you perceive as a barrier to care for your child?**
1. yes
 2. no
 3. don't know

Transportation & Social Support

1. **Are you sometimes unable to get to the pharmacy, hospital, or provider clinic because of lack of transportation?**
1. yes
 2. no
- If yes, how often?**
1. often
 2. sometimes
 3. rarely
 4. never

2. Do you feel unable to properly care for your child's asthma because of lack of social support?

1. yes
2. no

Personal Attitude and Knowledge

1. Do you personally feel restricted by having a child with asthma?

1. yes
2. no

2. Would you like to have more control over your child's care than their doctor allows?

1. yes
2. no

3. Are you comfortable with your knowledge about asthma and asthma management?

1. very comfortable
2. somewhat comfortable
3. somewhat uncomfortable
4. very uncomfortable

4. Do you feel that the information provided by your child's doctor is inadequate or hard to understand?

1. yes
2. no

5. Would you like your child's care providers to give you more information about asthma management?

1. yes
2. no

6. Please circle which of the following you would like more information about asthma management:

1. prevention
2. triggers
3. warning signs
4. differences between asthma and allergies
5. indications for different types of asthma medications
6. all of the above

Demographics

1. Are you:

1. male
2. female

2. Are you:

1. African-American or African-American, Non-Hispanic
2. White or European American, Non-Hispanic
3. Puerto Rican, Mexican American, or other Hispanic
4. Asian American, or Pacific Islander
5. Native American, American Indian
6. Other (please specify): _____

Figure 6. *Continued*

Other Comments

If there is anything else you would like to tell us about the management of your child's asthma that has not been addressed, please tell us in the space provided below.

Thank you for completing this questionnaire. All your responses are completely confidential.

Table 1. Description of Children included in Study Analysis			
	African-American (N = 281)	Hispanic (N = 877)	<i>*P</i>
Gender N, (%)			0.78
Male	157 (55.9)	498 (56.8)	
Female	124 (44.1)	379 (43.2)	
Age groups N, (%)			0.95
0-4 years	87 (32.1)	271 (31.7)	
5-9 years	93 (34.3)	287 (33.6)	
10-17 years	91 (33.6)	296 (34.7)	

* Calculated using chi-square.

Table 2. Description of Asthma Severity			
	African-American (N = 281)	Hispanic (N = 877)	<i>*P</i>
Asthma Severity N, (%)			0.008
Mild, Intermittent	155 (55.2)	407 (46.4)	
Mild, Persistent	89 (31.7)	278 (31.7)	
Moderate, Persistent	31 (11.0)	168 (19.2)	
Severe, Persistent	6 (2.1)	24 (2.7)	

* Calculated using chi-square.

Table 3. Description of Residential Exposures			
	African-American	Hispanic	<i>*P</i>
Residential Exposures N, (%)			
Cigarette/cigar smoke from mother	64 (31.2)	146 (21.8)	0.006
Cigarette/cigar smoke from others	117 (44.2)	271 (33.8)	0.002
cockroaches	68 (27.4)	285 (37.1)	0.005
dust	113 (47.7)	291 (39.5)	0.027
rodents	28 (11.7)	118 (15.8)	0.126
pet dog	33 (11.7)	174 (19.8)	0.002
pet cat	28 (10.0)	77 (8.8)	0.547
pet bird	7 (2.5)	98 (11.2)	< 0.001
pet rodent	4 (1.4)	15 (1.7)	0.742
pet other	9 (3.2)	31 (3.5)	0.791

* Calculated using chi-square.

Table 3a. Cross-tabulation of asthma severity by exposure to dust*		
	<i>*P</i>	
	Exposure to Dust 0.006	
Severity N, (%)	No	Yes
Mild, Intermittent	222 (54.5)	130 (43.0)
Mild, Persistent	119 (29.2)	99 (32.8)
Moderate, Persistent	61 (15.0)	63 (20.9)
Severe, Persistent	5 (1.2)	10 (3.3)

* Calculated using chi-square.

Table 4. Rates of Health Care Utilization Among Children with Asthma during Pre- and Post-Easy Breathing Periods by Asthma Severity and Type of Service			
	Pre-Easy Breathing (1997/1998)	Post-Easy Breathing (1999)	<i>P</i> *
	[mean (SD)]	[mean (SD)]	
Mild, Intermittent (N = 410)			
Outpatient Visits	3.9 (4.3)	3.3 (4.8)	0.002
ER Visits	0.78 (1.1)	0.32 (0.64)	< 0.001
Hospitalizations	0.12 (0.52)	0.10 (0.49)	0.574
Hospital Days	0.63 (5.2)	0.23 (1.2)	0.388
Antibiotic medications	0.37 (0.87)	0.24 (0.64)	0.003
Mild, Persistent (N = 277)			
Outpatient Visits	4.2 (4.5)	3.6 (3.8)	0.007
ER Visits	0.81 (1.3)	0.40 (0.87)	< 0.001
Hospitalizations	0.16 (0.49)	0.13 (0.45)	0.316
Hospital Days	0.42 (1.6)	0.32 (2.3)	0.071
Antibiotic medications	0.48 (0.94)	0.33 (0.71)	0.010
Moderate, Persistent (N = 147)			
Outpatient Visits	5.8 (5.0)	4.4 (4.0)	0.004
ER Visits	1.1 (1.5)	0.50 (0.86)	< 0.001
Hospitalizations	0.29 (0.71)	0.28 (1.1)	0.471
Hospital Days	1.0 (4.0)	0.74 (3.4)	0.253
Antibiotic medications	0.41 (0.85)	0.34 (0.71)	0.425
Severe, Persistent (N = 19)			
Outpatient Visits	7.4 (5.1)	7.9 (7.0)	0.932
ER Visits	1.6 (2.0)	0.32 (0.58)	0.008
Hospitalizations	0.63 (0.90)	0.11 (0.32)	0.031
Hospital Days	3.32 (5.5)	0.21 (0.71)	0.024
Antibiotic medications	0.32 (0.48)	0.47 (1.0)	0.782

All values in this table represent actual number of visits, hospitalizations, hospital days, and antibiotic medications per child/per year.

* Calculated using Wilcoxon signed-ranks test. Compares the mean distribution of each group for each health service *before* and *after* implementation of the Easy Breathing© Program.

Table 5. Percentage of Children with Asthma Using Health Care Services by Ethnicity and Type of Service			
	African-American (N = 172)	Hispanic (N = 605)	* <i>P</i>
Pre-Easy Breathing (1997/1998)	(%)	(%)	
Outpatient Visits	68.6	87.9	< 0.001
ER Visits	34.3	50.1	< 0.001
Hospitalizations	14.0	11.9	0.47
Hospital Days	14.0	11.8	0.44
Antibiotic medications	20.3	27.1	0.07
Post-Easy Breathing (1999)			
Outpatient Visits	72.7	86.0	< 0.001
ER Visits	23.3	27.6	0.26
Hospitalizations	7.0	9.3	0.35
Hospital Days	7.0	9.3	0.35
Antibiotic medications	15.7	21.3	0.10

All values in this table represent percentages of ≥ 1 visit, hospitalization, hospital day, and antibiotic medication per child/per year.

* Calculated using chi-square. Compares the distribution of each group for each health service during the specified study period.

Table 6. Rates of Health Care Utilization Among Children with Asthma during Pre- and Post-Easy Breathing Periods by Ethnicity and Type of Service			
	Pre-Easy Breathing (1997/1998)	Post-Easy Breathing (1999)	<i>P</i> *
	[mean (SD)]	[mean (SD)]	
African-American (N = 172)			
Outpatient Visits	2.9 (3.8) ^a	2.8 (3.9) ^c	0.588
ER Visits	0.51 (0.85) ^b	0.29 (0.58)	0.002
Hospitalizations	0.16 (0.46)	0.08 (0.29)	0.041
Hospital Days	0.61 (3.0)	0.16 (0.72)	0.064
Antibiotic medications	0.34 (0.93)	0.20 (0.54)	0.064
Hispanic (N = 605)			
Outpatient Visits	4.8 (4.7) ^a	4.0 (4.7) ^c	< 0.001
ER Visits	1.0 (1.4) ^b	0.40 (0.82)	< 0.001
Hospitalizations	0.19 (0.62)	0.17 (0.71)	0.224
Hospital Days	0.78 (4.7)	0.42 (2.4)	0.009
Antibiotic medications	0.41 (0.85)	0.31 (0.71)	0.006

All values in this table represent actual number of visits, hospitalizations, hospital days, and antibiotic medications per child/per year.

^{a,b,c} Means with the same letter in their superscripts differ significantly from one another according to a Mann-Whitney test with a .05 limit.

*Calculated using Wilcoxon signed-ranks test. Compares the mean distribution of each group for each health service *before* and *after* implementation of the Easy Breathing© Program.

Table 7. Description of Asthma Severity by Ethnicity and Asthma Symptoms						
	Intermittent Asthma^a			Persistent Asthma^b		
	African-American (N = 155)	Hispanic (N = 407)		African-American (N = 126)	Hispanic (N = 470)	
Asthma Symptoms	N, (%)	N, (%)	<i>*P</i>	N, (%)	N, (%)	<i>*P</i>
Wheeze/whistling in the chest	109 (71.2)	305 (76.6)	0.190	106 (85.5)	403 (89.0)	0.287
Wheeze with nighttime awakening cough	110 (71.4)	310 (77.9)	0.110	109 (87.2)	415 (91.6)	0.134
Cough, wheeze, or shortness of breath with exercise	87 (57.2)	225 (57.4)	0.973	58 (75.3)	249 (79.6)	0.425
Cough with colds that last for more than 10 days	62 (41.6)	194 (50.1)	0.077	66 (54.1)	267 (60.5)	0.200

^a Defined as children with Mild, Intermittent asthma.

^b Defined as children with Mild, Persistent; Moderate, Persistent; or Severe, Persistent asthma.

* Calculated using chi-square. There were no significant differences between ethnicities when stratifying by asthma severity and asthma symptoms at a 0.05 limit.

Table 8. Description of Asthma Symptoms by Ethnicity, Gender, and Age*				
	Wheeze/whistling in the chest	Wheeze with nighttime awakening cough	Cough, wheeze, or shortness of breath with exercise	Cough with colds that last for more than 10 days
African-American				
<i>Number</i>	215	219	181	128
% male	55.3	55.3	49.2	57.0
% female	44.7	44.7	50.8	43.0
Age groups N, (%)				
0-4 years	66 (32.2)	72 (34.3)	36 (20.7)	46 (37.7)
5-9 years	70 (34.1)	72 (34.3)	67 (38.5)	41 (33.6)
10-17 years	69 (33.7)	66 (31.4)	71 (40.8)	35 (28.7)
Hispanic				
<i>Number</i>	708	725	579	461
% male	58.1	57.9	56.3	54.0
% female	41.9	42.1	43.7	46.0
Age groups N, (%)				
0-4 years	233 (33.9)	235 (33.6)	145 (25.7)	142 (31.8)
5-9 years	225 (32.8)	242 (34.6)	192 (34.0)	160 (35.8)
10-17 years	229 (33.3)	223 (31.9)	228 (40.4)	145 (32.4)

* Calculated using chi-square. There were no significant differences between ethnicities when stratifying by asthma symptoms, gender, and age at a 0.05 limit.

Table 9. Logistic Regression analysis for ER visits, Number of Antibiotics, and Asthma Severity during Pre- and Post-Easy Breathing Periods			
	OR	95% C.I. ⁺	P*
Pre-Easy Breathing (1997/1998)			
ER visits	4.6 ^a	2.6-8.1 ^a	< 0.001 ^a
1 or more antibiotics	5.9 ^a	3.0-12.1 ^a	< 0.001 ^a
	3.1 ^b	1.5-6.3 ^b	0.002 ^b
Post-Easy Breathing (1999)			
ER visits	4.2 ^a	2.3-7.6 ^a	< 0.001 ^a
1 or more antibiotics	1.9 ^a	1.0-3.7 ^a	0.047 ^a
	2.2 ^b	1.2-4.1 ^b	0.008 ^b

⁺ C.I. = Confidence Interval

* Calculated using logistic regression.

^a Hispanic children aged 0-4 years.

^b Hispanic children aged 5-9 years.

Table 10. Overall Health Care Expenditures during Pre- and Post-Easy Breathing Periods*			
N = 855	Pre-Easy Breathing (1997/1998)	Post-Easy Breathing(1999)	*P
Variable	[mean (SD)]	[mean (SD)]	
Outpatient Visits	174.83 (182.92)	148.40 (177.72)	< 0.001
ER Visits	98.20 (144.13)	42.69 (86.20)	< 0.001
Hospital Days	1200.82 (7266.23)	607.89 (3676.80)	0.004

* Calculated using Wilcoxon signed-ranks test.

Table 11. Health Care Expenditures during Pre- and Post-Easy Breathing Periods by Ethnicity*		
	Pre-Easy Breathing (1997/1998)	Post-Easy Breathing (1999)
African-American (N = 172)	[mean (SD)]	[mean (SD)]
Outpatient Visits	115.58 (152.11)	111.40 (155.40)
ER Visits†	57.16 (95.84)	32.85 (65.51)
Hospital Days†	1068.31 (5184.60)	284.88 (1251.41)
Hispanic (N = 605)		
Outpatient Visits‡	192.07 (188.34)	160.66 (186.184)
ER Visits‡	112.44 (155.99)	45.57 (92.83)
Hospital Days†	1370.45 (8175.55)	734.71 (4281.50)

* Calculated using Wilcoxon signed-ranks test.

† Difference between ER visits and hospital days for this group of children in 1997/98 to 1999 significant at $P < 0.05$.

‡ Difference between outpatient and ER visits for this group of children in 1997/98 to 1999 significant at $P < 0.001$.